UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
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SR-6J

February 25, 2011

Richard Berggreen
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Chicago, IL 60602

Subject: **U.S. EPA Comments on the Response to Comments - Draft Biological Assessment Report of the Little Vermilion River Adjacent to Matthiessen and Hegeler Zinc Company Site, LaSalle, Illinois**

Dear Mr. Berggreen,

U.S. EPA has reviewed Geosyntec's Response to Comments on the Draft Biological Assessment Report of the Little Vermilion River (LVR) Adjacent to the Matthiessen and Hegeler Zinc Company Site submitted on February 8, 2011. For the reasons set out in this letter, U.S. EPA is disapproving the draft report and requiring that sediment toxicity testing be conducted for the LVR benthic community. Additionally, the attachment to this letter provides specific U.S. EPA comments on several of Geosyntec's responses.

After numerous reviews of the data collected specific to the LVR, it is U.S. EPA's position that further benthic toxicity testing will be required in order to make a determination on Geosyntec's findings that the macroinvertebrate community of the LVR adjacent to the Site is not significantly different from "background" species diversity measured at the same-stream reach reference, and therefore concluding that the sampled reaches of the LVR show "No Impairment" and are "Fully Supporting" of aquatic life use and are indicative of good resource quality. U.S. EPA found that the benthic survey method used by Geosyntec did not comply with IEPA's sampling protocol as was outlined in Geosyntec's approved Sampling and Analysis Plan. IEPA's sampling protocol specifies the number of bank zone habitat samples and the number of bottom zone habitat samples collected in a reach based on the river or stream width. Within the respective fixed number of samples, bank zone samples are supposed to be allocated according to the proportions of different bank zone habitats present in the reach, and, separately, the bottom zone samples according to the proportions of different bottom zone habitats in the reach. This portion of the protocol was not followed. Instead, the samples within a reach were allocated by the overall habitat proportions in the reach. This lack of compliance with IEPA's sampling

protocol makes the comparison of site mIBI values with regional thresholds impossible, which represents significant uncertainty regarding benthic risk.

Another confounding factor in making a conclusion on the health of the benthic community is the chemistry data collected for the LVR. The following is a brief synopsis of the chemistry data:

- LVR Surface Water - The following analytes had **more than one** detection greater than the Surface Water Ecological Screening Value;
    - Aluminum, Cadmium, Copper, Iron, Lead, Nickel, Selenium, Silver, Zinc, Cyanide (only sampled for water)
- LVR Sediment - The following analytes had **more than one** detection greater than the Sediment Ecological Screening Value:
    - Metals – Arsenic, Cadmium, Copper, Lead, Mercury, Nickel, Silver, Zinc, Cyanide
    - VOCs – Acetone
    - SVOCs – Benzo(a)anthracene, bis(2-Ethylhexyl)phthalate, Phenanthrene, Pyrene
    - PCBs – Aroclor 1242, Aroclor 1254
    - Pesticides – alpha-Chlordane, Dieldrin, Endrin
- Interstitial Well Groundwater Results - The following analytes had **more than one** detection greater than either the EPA Tapwater RSL or MCL:
    - Metals - Arsenic, Cadmium, Cobalt, Iron, Lead, Manganese, Zinc

Since neither the LVR's chemistry data nor the benthic community assessment findings present definitive and clear conclusions that the benthic community has not been adversely impacted by Site contamination, U.S. EPA strongly believes that another line of evidence is needed in order to fully assess whether contamination from the Site is negatively impacting the benthic community. Sediment toxicity testing coupled with the data already collected would provide a more complete weight of evidence than is currently in the biological assessment for the LVR and would allow for a more complete understanding of whether or not the benthic community is being impacted from the Site. Therefore, U.S. EPA is hereby requiring this additional toxicity testing for the LVR benthic community prior to moving forward with finalizing the Remedial Investigation and making any conclusions regarding the LVR.

Please feel free to contact me at (312) 886-0214 for any additional clarifications or questions.

Sincerely,

Demaree Collier
Remedial Project Manager

cc: N. Weeks – GeoSyntec (electronic only)
J. Knoepfle – SulTRAC (electronic only)
J. Chapman – U.S. EPA (electronic only)
C. Smith – IEPA – (electronic only)
T. Heavisides – Illinois DNR (electronic only)
M. Coffey – USFWS (electronic only

Attachment
U.S. EPA General and Specific Comments on Geosyntec's Responses

GENERAL U.S. EPA COMMENT:

It is recommended that Geosyntec revise the text to clearly state that the IEPA protocol as outlined in the sampling and analysis plan was not followed and there is uncertainty associated with the data.

SPECIFIC U.S. EPA COMMENTS

1. ***Section 2.0 - METHODS - p. 3:***

GEOSYNTEC RESPONSE: Macroinvertebrate sampling for the biological assessment (BA) of the Little Vermilion River (LVR) could not be entirely consistent with Illinois Environmental Protection Agency (IEPA) 2007 protocol because that protocol does not address the application of the sampling method to half of a river, as EPA and its contractor, SulTRAC, required for the BA. This fact was acknowledged in Field Sampling Plan Addendum No. 1 (FSP), which stated (on page 21) that the sampling would be in "general accordance" with the protocol and that the sampling would be done "by distributing the jabs proportionally among the multiple habitats present."

U.S. EPA COMMENT ON RESPONSE: The split river design had no impact whatsoever on the required allocation of bank-zone jabs and bottom-zone jabs per sample reach in the IEPA (2007) protocol. According to IEPA (2007) sampling protocol, jabs are to be distributed proportionally among multiple habitats, but the distribution should be evaluated separately for the bank-zone habitats (to proportionally allocate the specified number of band-zone jabs) and for the bottom-zone habitats (to proportionally allocate the specified number of bottom-zone jabs). The specified allocation of bank- and bottom-zone jabs for a given stream width is unchanged whether the sampling reach includes both banks and all of the bottom width between the opposing banks, or if the sampling reach includes only 1 bank and ½ of the adjacent bottom width. When both the number of banks and the width of bottom are divided in half to implement a split river design, the relative proportions of bank- and bottom-zones are unchanged.

The departure from the IEPA (2007) sampling protocol appears to have arisen from the same inattention to detail that resulted in invalid and inflated mIBI calculations in the initial draft submittal (May 2010) in which macroinvertebrate data were not standardized (by aggregating taxonomic data to genus) according to the cited IEPA protocol. In discussions, the lead Geosyntec Consultants investigator stated he read the data standardization section of IEPA's mIBI guidance, but neglected to implement the required procedure.

GEOSYNTEC RESPONSE- GENERAL TOPIC - Detailed lengthy discussion of conference call with Tetra Tech representatives involved in the preparation of Tetra Tech (2000).

U.S. EPA COMMENT ON RESPONSE: The Tetra Tech representatives were contacted under the mistaken impression that they collected the macroinvertebrate field data analyzed in Tetra

Tech (2000). Tetra Tech representatives initially stated they did not remember how the macroinvertebrate field data were collected, then stated that it was collected in proportion to habitat by reach, but, after further questioning, admitted they were not involved in the data collection and were tasked with analyzing an existing set of macroinvertebrate field data collected by IEPA, not Tetra Tech. Tetra Tech's opinion of the procedures utilized in a data collection effort that did not include Tetra Tech participation is a weak line of evidence, particularly when IEPA, the agency that did, in fact, collect the field data, states that the data were collected consistent with IEPA's macroinvertebrate sampling protocol.

Tetra Tech representatives offered two additional suggestions to help evaluate potential effects due to metals and to habitat differences. They asked whether there is evidence of on-site effects on Ephemeroptera (there are in some locations) as line of evidence for metals-related toxicity. The other was to more closely look at potential habitat differences between on-site and reference locations. In response to a verbal description of the reference and on-site conditions by Geosyntec Consultants, they expressed the opinion that the reference reach was not well matched with on-site on-site reaches, and, in the absence of site-related effects, would expect that the on-site locations would have higher mIBI scores compared to the reference location. They suggested that, because of the stream condition differences, roughly equivalent mIBI scores in reference and on-site locations could be an indication of on-site impacts. In other words, the Tetra Tech representatives consider habitat differences to be a possible confounding factor in interpreting the macroinvertebrate survey data collected for the Biological Assessment.

> ***GEOSYNTEC RESPONSE: Despite the marked differences between the 20-jab sampling method utilized in the 2001 sampling and the historic handpick method, Tetra Tech's analysis seemed to show that they performed about the same. As shown in Table 2 of Tetra Tech (2007), the 20-jab and handpick methods performed almost the same in correctly scoring known "most disturbed" sites using the 2000 Stream Condition Index. Tetra Tech also concluded that the revised Stream Condition Index (which ultimately became IEPA's mIBI index) "performed comparably to the old SCI with both the older data set (689 hand pick samples) and the pilot study data (158 – 20-jab 300 organism samples)."***
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> ***The difference between the 20-jab sample allocation used by Geosyntec and the 20-jab sample allocation per the IEPA 2007 protocol is a minor sample method difference when compared to the difference between the handpick method and any version of the 20-jab method. Thus, while the general comparability in predictive results achieved by the handpick method and the 20-jab method underlying the Tetra Tech (2007) does not directly show the comparability of the two methods of allocating the 20-jabs, it suggests that they would likely produce comparable results.***

U.S. EPA COMMENT ON RESPONSE: The Response provides an indirect line of evidence that the sampling protocol departure is unlikely to result in large differences in outcome. However, other lines of evidence, also indirect, indicate that habitat differences can confound assessment of localized impacts through macroinvertebrate survey methods. Comparisons of benthic survey data from two freshwater habitats, riffle and snag, have shown significant effects of habitat on

macroinvertebrate metrics and the consequent classification of stream quality. Findings are quoted a length below:

> "The weakness of using multi-habitat sampling for environmental assessment is that the taxa collected from a site may be weighted to the spatially dominant habitat type, and streams are assessed according to the particular habitat type represented rather than water quality or general environmental health ... Therefore, in making comparisons among streams, multi-habitat samples may introduce interhabitat variation that can potentially mask water quality differences among sites. …
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> About 64% of the 47 macroinvertebrate measures we tested differed significantly between riffles and snags. Eighty percent intercepts of regressions between biotic indices and urban or agricultural land uses differed significantly between riffles and snags. The Hilsenhoff biotic index calculated from snag samples explained 69% of the variance of riffle samples and classified 66% of the sites into the same stream health group as the riffle samples. However, four multimetric indices for snag samples explained less than 50% of the variance of riffle samples and classified less than 50% of the sites into the same health group as the riffle samples. …
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> The significant difference in macroinvertebrate measures between riffle and snag habitats, especially measures of feeding function and ETP groups, also potentially influences the outcome of macroinvertebrate environment assessments using multimetric indices. … It is substantial that for about half of our macroinvertebrate feeding measures, values for one habitat were more than double those for the other habitat, and for the other half of feeding measures, values for one habitat were 50% higher on average than for the other habitat. The EPT measures were 32% higher for one habitat than for the other habitat. If not corrected, such a large difference in the two macroinvertebrate groups between riffle and snag habitats could introduce substantial bias into the bioassessment results." (Wang, et al. 2006).
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> "Analysis of covariance indicated that samples from snag and riffle habitats differed significantly in their response to the urbanization gradient for the Hilsenhoff biotic index (BI), Shannon's diversity index, and percent of filterers, shredders, and pollution intolerant Ephemeroptera, Plecoptera, and Trichoptera (EPT) at each stream site ($p \leq 0.10$). These differences suggest that although macroinvertebrate assemblages present in either habitat type are sensitive to detecting the effects of urbanization, metrics derived from different habitats should not be intermixed when assessing stream quality through biomonitoring. …
>
> Stream quality metrics calculated from samples collected from snag habitats consistently indicated more degraded stream quality than those calculated from samples collected at riffle habitats at the same site. It is likely, therefore, that the physical habitat in these streams directly affects the estimation of water quality attributes based on the macroinvertebrates." (Stepenuck, et al. 2008).

Similarly, the sensitivity of macroinvertebrate metrics to dam-related stressors (combined physical stressors related to altered water flow and chemical stressors related to sediment

accumulation) differ depending on whether the macroinvertebrate data were collected from bank-zone habitat or from bottom-zone habitat (both sampled upstream of dams) (Colas, et al. 2011). In this particular example, benthic metrics based on bank-zone sampling were more sensitive to dam-related effects compared to metrics based on bottom-zone sampling. The reported relative sensitivities of bank- and bottom-zone macroinvertebrate metrics in the lentic (impounded water) environment of the study are likely different from the relative sensitivities of bank- and bottom-zone metrics in a lotic (free flowing water) environment because of differences in the bottom-zone physical characteristics in standing and free-flowing waters. The relevant point for this discussion is not the specific sensitivities reported by Colas, et al. (2011), but the fact that macroinvertebrate samples from bottom- and bank-zone habitats gave different indications of the impact of local stressors.

These studies, while not directly measuring effect of the lotic bank- vs bottom-zone allocation issue raised by the departure from IEPA macroinvertebrate sampling protocol in the surveys performed for the Biological Assessment, provide lines of evidence that habitat-related confounding effects can affect multi-habitat benthic metrics and influence assignment of stream quality categories in investigated reaches.

IEPA is cognizant of the habitat confounding effect as reflected in the draft protocol for detecting facility-related impacts to streams in which benthic samples are segregated by habitat, each habitat is sampled with the same intensity, and upstream-downstream comparisons are performed exclusively on the basis of matched habitats defined as "the subset of identical habitat types (e.g., cobble in fast velocity etc.) that co-occur at each and every monitoring site in a given FRSS" (Facility Related Stream Survey) (IEPA 2010).

Colas, F., V. Archaimbault, and S. Devin. 2011. Scale-dependency of macroinvertebrate communities: Responses to contaminated sediments within run-of-river dams. Sci Total Environ 409: 1336-1343.

IEPA. 2010. Methods of Sampling Wadeable Stream Macroinvertebrates for Detecting Chemical Impacts from Point-Source Discharges. 11 August 2010. Draft.

Stepenuck, K., R. Crunkilton, M. Bozek, and L. Wang. 2008. Comparison of macroinvertebrate-derived stream quality metrics between snag and riffle habitats. J Amer Water Resour Assoc 44(3): 670-678.

Wang, L., B. Weigel, P. Kanehl, and K. Lohman. 2006. Influence of riffle and snag habitat specific sampling on stream macroinvertebrate assemblage measures in bioassessment. Environ Monitor Assessm 119: 245-273.

2) Section 2.4 - Benthic Macroinvertebrate Community Sampling - p. 13-14:

GEOSYNTEC RESPONSE: Allocation of the proportional bank zone/bottom zone sampling method was specifically developed by IEPA to be applied to the full width of a

stream segment – not for river segments split in half length-wise. The IEPA 2007 sampling protocol simply has no discussion of how it should be applied in such a circumstance. That IEPA never contemplated such an application of its protocol seems obvious from their comments on the original Draft BAR. Those comments included questions suggesting that IEPA was uncertain whether the allocation percentages specified in the 2007 protocol for the full width of the river or half the width of the river would be used. In that context, it is unclear how EPA can support their interpretation of a sampling protocol developed by another agency with such certainty.

U.S. EPA COMMENT ON RESPONSE: The GEOSNYTEC RESPONSE correctly points out that IEPA (2007) does not discuss an approach for a split-river study design. The suggestion in IEPA's comments that the bank- and bottom-zone allocations should be based on a stream of one-half the width of LVR to accommodate the split-river design is incorrect because this would assume the presence of an additional set of banks in mid-stream. It should be noted that IEPA, in the same set of comments, correctly identified the original errors in the mIBI calculations of the initial draft of the Biological Assessment, but incorrectly identified the source of the error (attributed to failure to remove air breathing insects from the taxa lists, when the actual error was failure to aggregate taxa by genus, not by species). The misidentification of the source of the error in the original mIBI calculations had no bearing on the necessity of correcting the actual source of the error. Similarly, the mistaken comment on bank- and bottom-zone allocation does not change the fact that the departure from IEPA protocol introduces additional uncertainty in interpretation.

5) Section 3.2.5 - Fish Community Index of Biotic Integrity (fIBI) p. 30-31:

GEOSNYNTEC RESPONSE: Geosyntec will make appropriate revisions to the text of the Final BAR to make reference to the commenter's understanding of why the adjusted fIBI calculation was suggested.

While we have agreed to make these revisions, Geosyntec does not, for the record, recall the discussion at the 5 October 2010 resulting in the "explicitly stated" rationale described by the commenter. Rather, it seemed to us that the Revised BAR correctly reflected the reasons for the additional work. The Revised BAR is consistent with IEPA guidance that suggests an adjusted fIBI calculation if there is a concern with the precision or accuracy of the fIBI because "the total number of individuals in a sample is low" (IEPA, 2000). In addition, the IEPA guidance makes no reference to incompatibility of fish sampling methods and, in fact, has criteria for inclusion of sampling data irrespective of the methods of collection (IEPA, 2000 at page 9).

U.S. EPA COMMENT ON RESPONSE: For the record, the explicitly stated rationale described by the commentator was, in fact, made by James Chapman, U.S. EPA, at the meeting to Geosyntec because it was obvious, by the arguments made by Geosyntec that the request to perform the adjusted fIBI calculation was inappropriate because the fish sample numbers met IEPA's requirements, that Geosyntec did not understand the reason for the request. Dr. Chapman explicitly clarified at the meeting that the request was not related to fish numbers but

to provide a line of evidence whether the use of backpack electroshockers in this stream width may have introduced uncertainties for comparing site values to IEPA regional values due to possible differences in sampling effectiveness. Geosyntec did not dispute this clarification, or continue to argue after the clarification that the adjusted fIBI calculation was inappropriate because the fish numbers met IEPA requirements.

As pointed out in the GEOSYNTEC RESPONSE, the request to perform the adjusted fIBI calculation was not based on IEPA guidance, but was suggested as a means of evaluating the possible significance of the difference in the sample methods used by IEPA and Geosyntec. Since this aspect of the fish sampling methods (related to stream width) is not included in IEPA's protocol, no one is, or did, imply that the selection of backpack equipment for the Biological Assessment was inappropriate. IEPA identified the fish sampling method as a possible source of uncertainty, and suggested an approach to evaluate the potential significance.